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The Effects of Hiring Tax Credits on Employment of Disabled Veterans

Paul Heaton¹

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Since the large increase in unemployment brought about by the recession of 2007–2009, policymakers have expressed considerable concern regarding economic problems faced by veterans, particularly those who have been disabled as a result of service during the post-9/11 era. Recently, policymakers from both major parties supported expansions to tax credit programs that reward businesses that offer jobs to unemployed veterans, culminating in the November 2011 passage of the VOW to Hire Heroes Act (Pub. L. 112-56) containing several new credits. This legislation follows in the wake of expansions to the Work Opportunity Tax Credit (WOTC) program enacted in 2007 and 2009 that offered financial incentives to employers who hired certain groups of veterans, including those with service-connected disabilities. Despite the widespread perception among policymakers that tax credits can improve the job prospects of certain segments of the veteran population, including the disabled, there has been little rigorous empirical research establishing whether such tax credits are effective at actually increasing the employment of targeted groups.²

In this paper, I estimate the employment effects of a 2007 WOTC expansion that made tax credits of up to \$4,800 available to employers who hired disabled veterans who were recently discharged or unemployed for more than six months. Using a differences-in-differences, triple-differences, and

quadruple-differences research design that compares changes in employment over time across veterans and nonveterans, those with and without disability, and individuals who did and did not otherwise qualify for the credits, I estimate that the tax credits generated a statistically significant 2 percentage point increase in employment among targeted groups of disabled veterans. This impact translates to an additional 32,000 employed disabled veterans per year over 2007 and 2008. These impacts are observable for both those with cognitive and noncognitive impairments, but the largest effects appear to accrue to veterans aged 40 and above. Eligible veterans also increased wage income by around 40 percent, and the employment expansions occurred primarily for full-time versus part-time jobs. These findings suggest that tax credits may be an effective means to reduce unemployment among disabled veterans.

Tax credits represent only one of a series of programs and initiatives that have been introduced in recent years aiming to improve the employment prospects of veterans.³ Unfortunately, for many existing programs there has been limited effort to rigorously measure program impacts on employment outcomes. Constraints on the federal budget may limit available resources for veteran employment initiatives in the future, so achieving improvements in veterans' employment situation via governmental programs will likely require focusing resources on those programs that are most successful. Quantitative evaluations, such as the one reported in this paper, provide a vital means of identifying which of the myriad of current programs offer the greatest potential to improve the employment situation of veterans at lowest cost.

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² GAO (2002), for example, argues that "Little information is available regarding the effectiveness of the incentives [tax credits] on encouraging the hiring, retention, and accommodation of workers with disabilities, and data limitations preclude conclusively determining their effectiveness."

³ Other examples include the Veterans Job Bank established through a partnership of the Departments of Labor, Defense, and Veterans Affairs; the Department of Labor's Veterans Gold Card program, which provides job referrals and career guidance for veterans; and the U.S. Chamber of Commerce's Hiring Our Heroes program.

Achieving improvements in veterans' employment situation will require focusing resources on those programs that are most successful.

The Work Opportunity Tax Credit Expansions

My analysis focuses on employer tax credits offered through the federal Work Opportunity Tax Credit (WOTC) program. The WOTC was enacted in 1996 to increase employment among certain traditionally hard-to-employ segments of the population.⁴ The program established a set of seven target groups, such as ex-felons, Aid to Families with Dependent Children (AFDC)/Temporary Assistance for Needy Families (TANF) recipients, or residents of enterprise zones or empowerment communities. Individuals from these groups who meet certain additional requirements, based on such factors as age or intensity of use of entitlement programs, are deemed WOTC-eligible, in which case employers who hire them can apply for a credit as part of their federal tax return. The amount of the tax credit is equal to 25 percent of wages for employees who work between 120 and 400 hours and 40 percent of wages for employees with 400 hours or more, up to a predetermined cap, which is \$2,400 for most target groups.⁵ The subsidy is only available for the first year following hire. The program is re-authorized on a 1–3 year cycle, and over time eligibility criteria have been adjusted for certain target groups, some groups have been added or removed, and, in a few instances, the amounts of the subsidies have been modified. Eligibility for the subsidies is limited to private enterprises and other taxpaying entities and there are specific exclusions for hiring relatives or former employees.

The WOTC program has been expanded a number of times in an effort to encourage hiring of veterans. The initial set of target groups included “qualified veterans,” but this group was fairly narrowly defined because it required individuals to both be veterans and to have received AFDC/TANF within at least nine of the past 12 months or food stamps for three of the 12 months preceding hire. In May 2007, Public Law 110-28 authorized the expansion of the WOTC to include veterans who were entitled to compensation for a service-connected disability who had either been discharged from service within the past 12 months or who had been unemployed for at least six of the 12 months prior to their hire date. The maximum value of the credit was also set at \$4,800 rather than \$2,400 for this group. I focus

on this expansion in estimating the impacts of the tax credits. In 2009, the program was augmented again as a part of the American Recovery and Reinvestment Act (ARRA), adding two new target groups—unemployed veterans who had been discharged within the past five years who had collected unemployment benefits for at least four weeks within the past 12 months, and “disconnected youth” aged 16–24 who had neither regularly worked nor attended school within the past six months. Although the two new groups defined in the ARRA were allowed to expire at the end of 2010, the unemployed veterans group was reintroduced with the passage of the VOW to Hire Heroes Act in November 2011. The act also increased the maximum tax credit for long-term unemployed disabled veterans to \$9,600, expanded the unemployed veterans target group to include those discharged more than five years ago, and introduced a new \$5,600 maximum credit for veterans unemployed for more than six months.

Theoretically, tax credit programs such as the WOTC should increase the quantity of labor employed for those in the target groups by lowering the effective wage schedule faced by employers who hire such workers. Although, to my knowledge, this represents the first evaluation of recent tax incentives designed to promote hiring of disabled veterans, there have been prior studies of employer hiring incentives for disadvantaged groups. Katz (1998) and Neumark (2011) provide good summaries of research in this area. Findings on the employment impacts of past hiring credits have been somewhat mixed. Katz (1998), for example, presents evidence that the Targeted Jobs Tax Credit (TJTC), a precursor to the WOTC, generated modest employment gains among eligible disadvantaged youth, and similar small positive employment effects have also been estimated for state employer-based hiring incentive programs (Bartik and Erickcek, 2010). However, there is also evidence that some programs can generate a stigma effect, labeling targeted workers as difficult to employ and thereby reducing their employment prospects (Burtless, 1985).

A handful of studies have specifically examined the impacts of the WOTC. Hamersma (2005, 2008) argues that the WOTC had minimal effects on employment among targeted groups, largely because take-up of the credits is low. This view is consistent with survey evidence compiled by the U.S. General Accounting Office (GAO, 2001) and the Department of Labor (2001) indicating that employers had low awareness of the tax credits and that the credits did not affect employer hiring practices.

⁴ See Pub. L. 104-188.

⁵ The program thus provides some incentives to hire full-time as opposed to part-time workers. For example, an employer who hires two eligible part-time workers for the final 10 weeks of the year at \$8 an hour would pay them \$1,600 each (10 weeks x 20 hours per week x \$8 per hour) and receive \$800 in tax credits, whereas hiring a single full-time worker would cost the same \$3,200 in total salary but entitle the employer to \$1,280 in credits.

Data

I turn to the 2005–2008 American Community Survey (ACS) public-use microdata samples (PUMS) to analyze the impact of the 2007 WOTC expansion.⁶ Designed to replace the decennial census long form, the ACS includes a roughly 1 percent nationally representative sample of the U.S. population, with questions about basic demographic characteristics, housing, and work and earnings.⁷

An important advantage of the ACS relative to other labor market surveys is that it includes questions regarding prior military service—including a question differentiating those who have served on active duty within the past 12 months but who are no longer serving from those who served more than 12 months ago—disability status, food stamp receipt, and length of unemployment within the past year.^{8,9} These items permit me to identify individuals who would have been eligible for the tax credit following the 2007 expansion based on disability status combined with recent prior service or more than six months of unemployment within the past year. I focus my analysis on the initial expansion because later expansions were linked to receiving unemployment compensation rather than simply being unemployed, making it more problematic to cleanly identify eligible recipients using available data. The rich demographic data included in the ACS also permit me to control at the individual level for a range of characteristics, such as age, educational attainment, marital status, and location, that may differ between those who were eligible for the expansion and those who were ineligible.

Table 1 presents summary statistics describing the characteristics of the sample population

organized by veteran status, employment history qualification status (recent discharge or more than six months of unemployment), and disability status. Substantial numbers of survey respondents fall within each of the veteran/disability/employment history qualification groups; the bottom row of the table indicates that in 2008 approximately 1.4 million veterans were disabled and otherwise met the criteria for inclusion in the tax credit program; of these about 35,000 were recently discharged, and the remainder were long-term unemployed.¹⁰ As expected, employment shares are much lower among the employment-history qualified and the disabled. Comparing veterans and nonveterans who are both employment-history qualified and disabled, employment shares are of similar magnitude for the two groups but in both cases below 10 percent. There are also important differences across the groups in some characteristics, such as age, gender, and educational attainment. Table 1 suggests that properly accounting for differences between those who were and were not eligible for tax credits is key for this analysis; I accomplish this by both explicitly controlling for demographic factors, such as those listed in Table 1, and by exploiting variation over time in eligibility for the credits.

Estimation Approach

To estimate the impact of the tax credits, we must establish what employment for eligible groups would have been in 2007 and 2008 in the absence of the tax credit. The difference between this counterfactual employment rate and actual observed employment provides a measure of the impact of the expansion. To construct the counterfactual employment rate, I use observed employment patterns for individuals who were similar to those that were included under the tax credit but who failed to meet one of the eligibility criteria.¹¹

The intuition behind this analytic approach is illustrated in Figures 1–3. Figure 1 plots the employ-

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⁶ Although ACS data prior to 2005 do exist, in these years the ACS was still in its demonstration phase and the sample sizes were much smaller. 2005 was the first year of full ACS implementation.

⁷ Response rates were between 97 and 98 percent for the four years analyzed in this study.

⁸ The ACS includes a series of questions that capture functional disability status, which can reflect physical, mental, or psychological impairment. Respondents are asked whether they have conditions that limit such activities as seeing, concentrating, remembering, working, lifting, or bathing. I use these questions to determine disability for the purposes of my analysis. However, WOTC eligibility for veterans is based on service-connected disability, which does not perfectly correspond to functional disability. In 2008, the ACS for the first time collected information about service-connected disability ratings, which I consider in one of my robustness checks below.

⁹ The Census Bureau changed the set of questions used to assess disability between the 2007 and 2008 waves of the ACS in an effort to refine the ability of the survey to properly identify various types of disability (Brault and Stern, 2007). This change is not likely to be problematic for my estimation, since it applied to both treatment and control groups and thus its effects should be differenced away in the analysis. However, the wording change did result in a decline in the absolute number of disabled persons identified across survey waves.

¹⁰ Although public discussions of the veteran employment situation typically focus on younger veterans who have served in the post-9/11 period, it is notable that of the veterans eligible for the tax credits in 2008, 65 percent had served during the Vietnam era and only about 6 percent had served since 9/11.

¹¹ Here the employment rate is measured as the fraction of the total population who are employed, which differs from the commonly used Bureau of Labor Statistics definition of employment, which is computed as a fraction of the labor force, where the labor force is defined as those who are working or actively looking for work. Employment rates are measured relative to the entire population, because the effects of tax credits may be to both allow those who are looking to find work more quickly and to encourage those who otherwise might not be actively seeking work (for example, due to discouragement about the prospects of finding a job) to obtain employment.

ment shares over time and by disability status for veterans in the ACS who had either ended their active duty service within the past 12 months or who had been unemployed for at least six of the 12 months prior to the survey. As might be expected, employment rates are low among the disabled, and employment rates for both groups fell with the onset of the recession in 2007. Prior to 2007, hiring tax credits did not apply to either group, but as of 2007, credits were available to employers who hired those

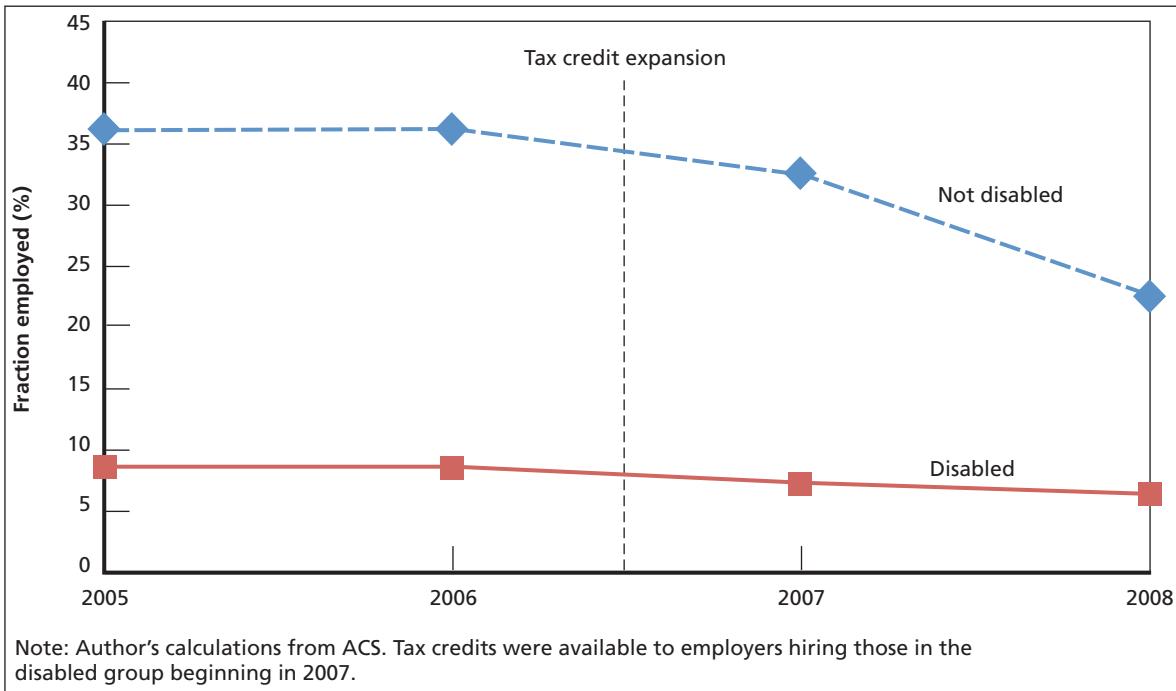
who were disabled but not those who were not disabled. Figure 1 reveals that while the employment gap between the disabled and nondisabled was fairly stable between 2005 and 2006, after the policy was initiated, employment fell much less for the disabled group than for the nondisabled group. If the nondisabled are a valid control group, this pattern suggests that, absent the program, employment for the disabled would have fallen more dramatically. Comparing the pre/post-tax credit differences in employment

Table 1
Average Characteristics of ACS Sample by Veteran, Employment History Qualification, and Disability Status

Characteristic	Veterans				Nonveterans			
	Could Qualify Based on Employment History		Not Qualified Based on Employment History		Could Qualify Based on Employment History		Not Qualified Based on Employment History	
	Disabled	Not Disabled	Disabled	Not Disabled	Disabled	Not Disabled	Disabled	Not Disabled
Male	.925	.873	.926	.917	.415	.351	.483	.502
Age	54.4 (9.3)	48.8 (14.5)	51.6 (10.0)	48.6 (10.8)	46.0 (13.8)	35.4 (15.4)	43.9 (12.5)	39.4 (12.1)
Married	.531	.604	.644	.697	.376	.445	.470	.560
U.S. citizen	.996	.992	.996	.995	.951	.867	.937	.900
Race/ethnicity								
White	.775	.779	.823	.821	.702	.692	.756	.762
Black	.156	.152	.109	.123	.187	.143	.127	.106
Hispanic	.055	.065	.056	.060	.122	.177	.126	.147
Educational Attainment								
Less than high school	.125	.051	.065	.033	.346	.260	.182	.109
High school	.375	.321	.312	.291	.347	.290	.336	.274
Some college	.288	.297	.311	.290	.179	.224	.232	.222
College graduate	.212	.331	.312	.386	.128	.226	.250	.395
Currently attending school	.033	.100	.048	.052	.080	.294	.077	.105
Received food stamps	.147	.065	.065	.032	.282	.124	.117	.050
Any Social Security income	.441	.230	.065	.025	.320	.076	.060	.011
Employed	.078	.319	.899	.953	.073	.213	.887	.946
Wage income	\$2,501 (11,406)	\$12,764 (26,537)	\$39,132 (37,080)	\$51,771 (50,026)	\$1,137 (6,244)	\$3,119 (11,905)	\$28,877 (32,480)	\$40,431 (46,901)
Hours per week	2.9 (11.0)	13.2 (21.0)	38.2 (17.5)	41.9 (14.0)	2.2 (8.7)	6.6 (14.2)	34.3 (17.2)	38.5 (14.3)
ACS sample size (thousands)	75.29	114.35	42.21	381.1	525.1	1,594	280.3	4,392
U.S. total in 2008 (thousands)	1,418	2,647	922.6	8,893	11,626	42,700	6,548	120,700

Figure 1

Employment Rates for Veterans with Recent Discharge or Six or More Months of Unemployment, by Disability Status



across these two groups (differences-in-differences) provides one means of assessing the impacts of the tax credit expansion.

However, the simple comparisons in Figure 1 are subject to several potential concerns regarding interpretation. If other factors changed in 2007 in a way that improved the employment situation of the disabled, we might see patterns such as those in Figure 1 even if the WOTC expansion had no impact on employment. Moreover, it seems possible that the nondisabled may not be a valid control group for the disabled due to noncomparabilities between the two groups. Figures 2 and 3 provide additional evidence regarding the appropriateness of using employment trends among the nondisabled population as a means to understand counterfactual employment patterns among the disabled. Figure 2 plots employment patterns among nonveterans with at least six months of prior unemployment, again by disability status. Neither of the two groups in Figure 2 was eligible for the tax credits, although those who were disabled would have been eligible after 2007 had they been veterans. We again see lower unemployment among the disabled, but no evidence of a relative improvement after 2007 for this group, suggesting that the patterns in Figure 1 cannot be explained by general improvements in employment among the disabled population. Moreover, the

employment trends between the nondisabled and disabled track each other fairly closely, suggesting the nondisabled provide an informative comparison group. Similarly, comparing employment rates among nondisabled and disabled veterans who did not qualify for the expansion because they had been discharged more than one year ago and had fewer than six months of unemployment within the past year (Figure 3), we see very similar trends across the two groups.

To obtain quantitative estimates of the impact of the tax credits on employment, I employ differences-in-differences (DD), triple-differences (DDD), and quadruple-differences (DDD) regression approaches. Let $y_{ivdq}t$ represent an indicator for whether individual i with veteran status v , disability status d , and employment history qualification status q surveyed in year t is employed. Here there are two categories for employment history qualification status—those individuals who reported active service within the past 12 months or more than six months of unemployment at the time of the survey, and who therefore could have qualified for credits on this basis, and those individuals who did not. Let $Eligible_i$ represent an indicator for whether those who hired individual i would have been eligible for a tax credit, so $Eligible_i$ is 1 for employment-history-qualified disabled veterans surveyed in 2007 and 2008 and 0 oth-

Employment trends between the nondisabled and disabled track each other fairly closely, suggesting the nondisabled provide an informative comparison group.

Figure 2
Employment Rates for Nonveterans with Six or More Months of Unemployment, by Disability Status

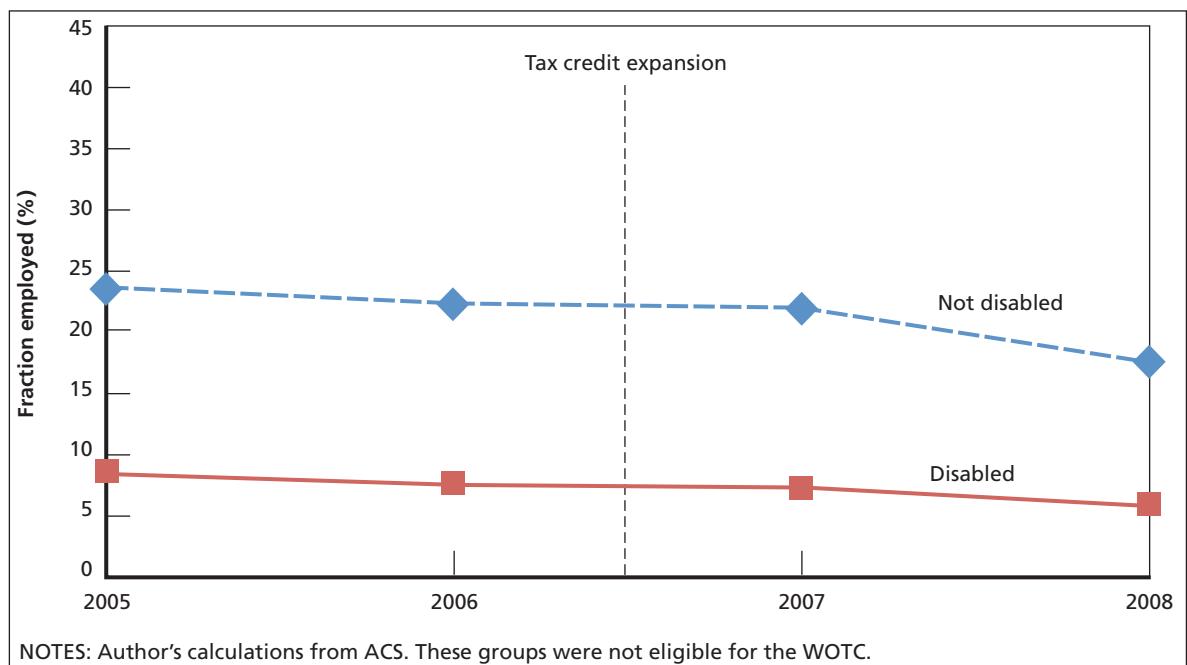
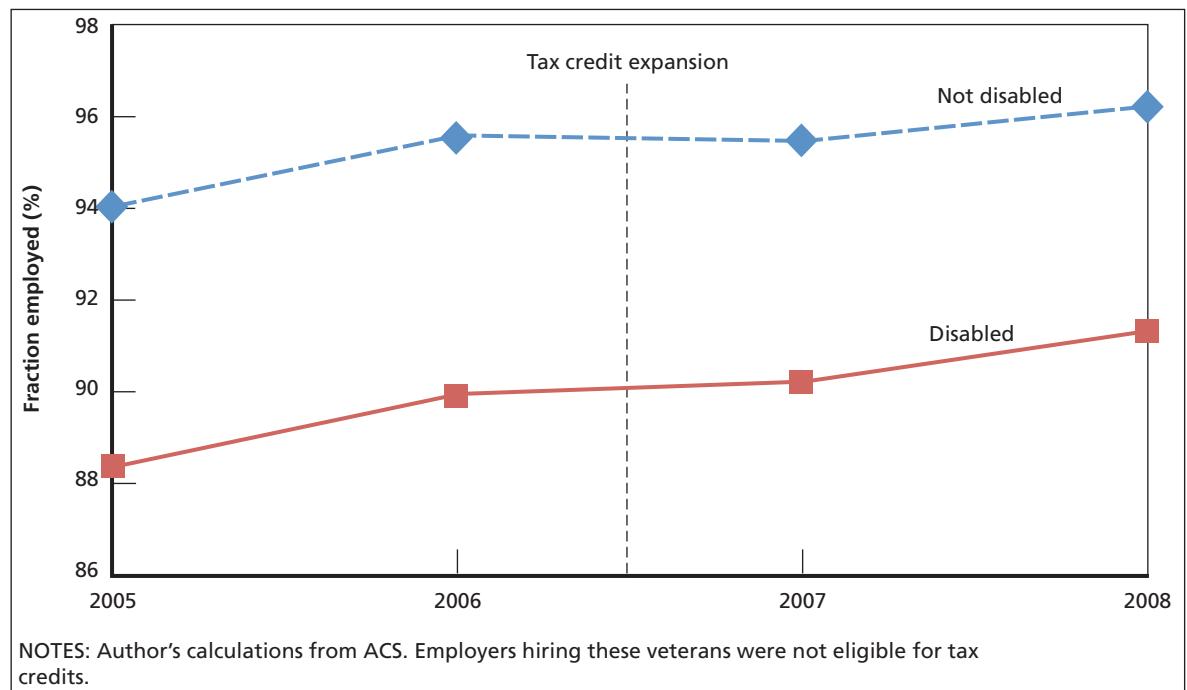


Figure 3
Employment Rates for Veterans Without Recent Discharge and Less Than Six Months of Unemployment, by Disability Status



erwise.¹² Let X_i denote a set of control demographic characteristics for individual i , such as age, gender, race, educational attainment, and location. Let I_m denote a full set of indicators for characteristic m . In the regression equations

$$Employed_{idt} = \alpha \cdot Eligible_i + \beta X_i + I_d + I_t + \varepsilon_i \quad (DD)$$

$$Employed_{ivdt} = \alpha \cdot Eligible_i + \beta X_i + I_d I_t + I_v I_t + I_v I_d + \varepsilon_i \quad (DDD)$$

$$Employed_{ivdqt} = \alpha \cdot Eligible_i + \beta X_i + I_v I_d I_q + I_v I_d I_t + I_d I_q I_t + I_v I_q I_t + \varepsilon_i, \quad (DDDD)$$

α estimates the impact of the tax credits, essentially by comparing employment rates after and before the WOTC expansion across different groups defined by veteran, disability, and employment history qualification status and survey date. In the simple DD version of the equation, I limit the sample to employment-history-qualified veterans and compare changes over time in employment among disabled and nondisabled individuals. In the triple-differences regressions, I expand the sample to include employment-history-qualified nonveterans, which permits me to include a full set of two-way interactions—for example, interactions between veteran status and year ($I_v I_t$)—as

additional controls. Such interactions allow me to account for potentially unobserved factors that may have affected veterans or the disabled at a particular moment in time. Finally, in the quadruple-differences regression I expand the sample to include both veterans and nonveterans who did not qualify for tax credits due to lack of prior unemployment. For these regressions, I am able to include three-way interactions as controls, meaning that I can correctly estimate the impacts of tax credit eligibility even in the presence of unobserved factors that affect fairly narrowly defined groups. For example, because the quadruple-differences regression includes separate controls for disabled veterans in 2007 or employment-history-qualified veterans in 2008, even if other programs targeting these specific groups were introduced at the same time as the tax credit expansion, equation DDDD can still be used to correctly estimate the impact of the tax credits. The assumption required for the equation to deliver valid estimates of the employment effects of the credits is that there were no other factors introduced at the same time as the tax credits that specifically affected employment of disabled veterans who had been unemployed for six months or more or recently discharged.

Across all three specifications, we observe a positive and statistically significant impact of the program on employment.

Results

Table 2 reports regression estimates of the impact of the tax credits on employment of disabled veterans obtained using the estimating equations above. Because eligibility for the expanded credit is based on survey timing and group status, in this and subsequent tables, standard errors have been clustered at the group/year level, where a group is defined based on veteran, disability, and employment history qualification status.

Table 2
Estimated Impacts of Tax Credit Eligibility on Employment of Disabled Veterans

	Estimation Approach		
	DD	DDD	DDDD
Impact of tax credit eligibility on employment probability	.048* (.017)	.023** (.006)	.018** (.005)
Sample size	189,632	2,309,026	7,404,418
NOTES: This table reports coefficient estimates from multiple-differences ordinary least squares (OLS) regressions of an indicator for whether an individual was employed on an indicator for eligibility for tax credits and additional controls. The unit of observation is an individual. All samples are limited to individuals aged 18–65, and each entry reports a coefficient estimate from a separate regression. The sample for the DD regressions is employment-history-qualified veterans; the sample for the DDD regressions is employment-history-qualified individuals; and the sample for the DDDD regressions is the overall population. Other demographic controls include a quintic polynomial in age; indicators for gender interacted with educational attainment, race, ethnicity, citizenship status, marital status, school attendance, and state of residence; and interactions between food stamp status and group. Regressions are weighted using Census person weights. Standard errors clustered on veteran/disability/employment history qualification status/year are reported in parentheses.			
* Denotes statistical significance at the two-tailed 5 percent level.			
** Denotes statistical significance at the 1 percent level.			

Across all three specifications, we observe a positive and statistically significant impact of the program on employment. In the DDD and DDDD specifications, which better control for unobserved factors that may affect employment patterns of the disabled, we observe a roughly 2 percentage point increase in employment among the target population following the implementation of the tax credit. Applying the disabled veteran target group definitions to the ACS data, the tax credit can account for about 32,000 additional employed disabled veterans in both 2007 and 2008.¹³

In Table 3, I report additional estimates designed to test the robustness of my results to specification changes, focusing on the more credible DDD and DDDD estimates. Since the tax credits were passed in May of 2007 and the month of survey administration is not recorded in the ACS PUMS files, there is some ambiguity regarding how to assign eligibility for those surveyed in 2007. In my baseline estimates, I assign 2007 respondents as being fully eligible, which likely makes sense if there was some anticipation of the pending policy change. However, to test the sensitivity of my results to that coding scheme, in specification 1 I scale eligibility for those observed in 2007 by 7/12, which represents the number of

months the program was available that year. This adjustment increases the estimated impact of the program somewhat, but the basic conclusion that the program generated a modest yet statistically significant impact on employment remains unchanged.

Specification 2 uses responses to the ACS question “Last week, did this person work for pay at a job (or business)?” as the employment outcome measure rather than official employment status. This alternative measure of employment yields very similar results. Specification 3 codes tax credit eligibility using an alternative measure of disability. WOTC eligibility for veterans is tied to the service-connected disability rating, but this is not measured in the ACS until 2008, forcing me to proxy for disability eligibility using ACS questions that capture functional disability that are available in all years. In Specification 3, I substitute the true-service connected disability determination in place of my proxy for the 2008 data in an effort to assess whether reliance on this proxy measure contaminates the estimates. Reassuringly, the estimates remain fairly similar when adopting this alternative (and arguably more correct) disability measure, suggesting that the reliance on a proxy may not be particularly problematic.

Because employment rates among the disabled population are appreciably below those of their nondisabled counterparts, one potential concern with a linear model is that it may be subject to floor effects—employment rates among the disabled cannot decline more than about 8 percentage points to zero, whereas this is not necessarily true for the comparison groups.¹⁴ Specification 4 uses a logit rather than a linear formulation for the model, which essentially models the impacts of the tax credits as a percentage change rather than an absolute change. This eliminates the problem of floor effects. The odds ratios reported in the table again suggest positive and significant impacts of the tax credits. The magnitude of the DDDD estimate equates to a roughly 1 percentage point increase in employment stemming from tax credit eligibility.

Although it seems likely that the demographic controls included in the baseline specification are adequate to account for the differences between the eligible and ineligible populations documented in Table 1, in specification 5 I conduct an additional check by estimating a version of the model that includes a full set of interactions for gender, race/ethnicity, educational attainment, current school enroll-

Table 3
Robustness Checks of Impact Estimates

Specification	Estimation Approach	
	DDD	DDDD
1. Alternative coding for eligibility	.035** (.003)	.029** (.004)
2. Alternative employment measure	.023** (.004)	.011* (.004)
3. Alternative disability measure	.033* (.014)	.018** (.007)
4. Logit (odds ratio)	1.16* (0.08)	1.12* (0.06)
5. Matching-type estimates	.021** (.006)	.014** (.005)
6. Exclude food-stamp recipients	.020** (.006)	.013* (.005)

NOTES: This table reports DDD and DDDD regressions analogous to those in Table 2 that use different samples and specifications, as described in the text. See notes for Table 2. Each table entry reports a coefficient from a separate regression.

¹³ Because ACS data capture each individual at only a single point in time, these data cannot allow us to draw inferences about the duration of jobs created. These results would be consistent with both a situation in which there were 32,000 people hired in 2007 who remained at their jobs indefinitely and a situation in which 32,000 people were hired each year and then fired after one year. Future analyses using longitudinal data would provide better information about whether the credits generated long-lasting jobs.

¹⁴ However, conditional on the covariates in my model, over 98 percent of the predicted values from my baseline DDDD regression are within the unit interval, suggesting that the use of a linear model is not likely to be problematic in this setting.

ment status, age, and state of residence as controls. This in effect compares each eligible veteran to the set of ineligible control individuals who are identical across all of the dimensions listed above, and thus is akin to a matching estimator. The estimated impacts remain virtually the same.

Assigning tax credit eligibility for food stamp recipients is somewhat problematic given that both veterans and members of the general population receiving food stamps could have potentially been eligible for tax credits, depending on different criteria related to age and the length of time the individual was receiving food stamps.¹⁵ For simplicity, in the baseline estimates I coded all veterans receiving food stamps as eligible for the credits. In Specification 6 I test the robustness of my results to the exclusion of all food stamp recipients, which circumvents issues related to how to assign eligibility for this population. Excluding food stamp recipients does not appreciably alter the results.

As an additional test of the model, in Table 4 I report estimates of the impact of the tax credit expansion on employment of veterans in particular industries. The WOTC was only available to private

corporations, so it did not create incentives for government agencies or nonprofits to increase hiring of disabled veterans.¹⁶ If the statistical model properly captures the impacts of the tax credits, we should observe increases in private employment but not employment in other industries. The estimates in Table 4 thus provide a falsification test that examines whether the model demonstrates impacts only among those employers that would logically be affected by the tax credit expansion.

Consistent with the hypothesis that the employment effects measured up to this point reflect impacts of the tax credits, Table 4 reveals that the largest employment point estimates accrue for employment in the private sector, and this is the only sector which shows consistently positive and statistically significant employment effects. The private-sector employment impact of 1.2 percentage points using the DDDD methodology is almost as large as the overall DDDD employment impact of 1.8 percentage points reported in Table 2. Few potentially unobserved confounding factors would affect private-sector employment but not employment in other sectors, so these results reinforce the conclusion that the DDDD estimates properly capture the impacts of the tax credits rather than other factors.

In addition to assessing overall employment effects, we can also ask whether employment effects differed for particular subgroups in the disabled veteran population. Table 5 presents estimates of the employment impacts of the tax credits for population subgroups defined by age, gender, labor market disadvantage, type of disability, and Social Security receipt. In each case, the employment impacts have been estimated using the multiple-differences specification described previously but confining the sample to particular population subgroups. To identify disadvantaged individuals, I split the sample population into groups defined by gender, race/ethnicity, education, 10-year age group (20–29-year-olds, 30–39-year-olds, etc.), and state of residence, and for each group I calculated the fraction of the population who were employed in 2005–2006. I then define as disadvantaged those who belonged to groups for which the rate of employment was below 50 percent; I define the remainder of the population as not disadvantaged. This approach is designed to identify individuals who are less likely to be employed based on their demographic and educational characteristics. Using this definition, 15 percent of sample respondents are categorized as disadvantaged, and in 2005–2006 38 percent of the disadvantaged group was employed, versus 76 percent for the not disadvantaged group.

Table 4
Estimated Impacts of Tax Credit Eligibility on Employment of Disabled Veterans by Sector

Effect on probability of employment in:	Estimation Approach	
	DDD	DDDD
Private sector	.009* (.003)	.012* (.005)
Federal government	.007 (.009)	.004 (.008)
State and local government	.002** (.0004)	-.005** (.002)
Not-for-profit sector	.002 (.001)	.004** (.001)
Self-employment	.004** (.001)	.002 (.002)

NOTES: This table reports DDD and DDDD regressions analogous to those in Table 2 where the outcomes are indicators for whether an individual was employed in a particular sector. See notes for Table 2. Each table entry reports a coefficient from a separate regression. Only private-sector employers were eligible for tax credits.

¹⁵ The ACS includes information about the value of food stamp benefits but not the number and timing of months of benefits, which is what would be needed to correctly assign eligibility.

¹⁶ In theory, the tax credit could have generated general equilibrium supply effects that actually decreased hiring in noncovered industries; for example, by inducing job seekers to focus their search efforts on employers who were eligible for the credits. However, because the supply of eligible workers is large relative to the estimated impact of the program, such general equilibrium effects seem unlikely to arise in the present context.

The effects of the credits largely accrued to older veterans, the vast majority of whom served prior to 9/11. Impacts also appear larger among those who are not from disadvantaged demographic groups.

Table 5 reveals that the estimated impact of tax credit eligibility on employment is not statistically significant for those under age 40. Apparently, the effects of the credits largely accrued to older veterans, the vast majority of whom served prior to 9/11. Impacts also appear larger among those who are not from disadvantaged demographic groups, a finding that may reflect the fact that disadvantaged veterans face larger structural hurdles to obtaining employment than can be readily overcome by tax credits. The results by gender provide suggestive evidence that the impacts of the credits were larger for men

Table 5
Differential Effects of the Tax Credits Across Different Population Subgroups

The estimates suggest that tax credits have a beneficial employment effect for individuals with both cognitive and noncognitive disabilities.

Estimated Impact Among:	Estimation Approach	
	DDD	DDDD
Age		
Under 40	-.011 (.012)	-.011 (.013)
40 and over	.021** (.004)	.015** (.004)
Disadvantage		
Disadvantaged	.001 (.004)	.009 (.005)
Not disadvantaged	.022** (.006)	.013* (.005)
Gender		
Male	.014** (.004)	.010 (.006)
Female	-.004 (.012)	-.006 (.018)
Eligible, by type of disability		
Cognitive	.029** (.008)	.015 (.012)
Noncognitive	.020** (.005)	.021** (.006)
Eligible, by Social Security receipt		
Receiving Social Security	.001 (.010)	-.014 (.008)
No Social Security	.038** (.005)	.037** (.005)

NOTES: This table reports DDD and DDDD regressions analogous to those in Table 2 where the effects of the tax credits have been estimated for a particular population subgroup. For the "Eligible, by type of disability" and "Eligible, by Social Security (SS) receipt" entries, the sample was limited to noneligible controls and eligible individuals with the listed characteristic; for the remaining entries, the sample was split according to the listed characteristic. Disadvantaged individuals are individuals who are less likely to be employed based on their demographic characteristics; see text for more explanation of how this measure was constructed. Each table entry reports a coefficient from a separate regression.

than women, although the relatively small number of eligible women and the corresponding imprecision of the estimates for this group preclude drawing definite conclusions.

One natural question is whether the tax credits are equally effective at helping veterans with different types of disability. Although the ACS does not provide much detail about the nature of disability, available questions do allow us to differentiate respondents with cognitive impairments, which may result from mental health conditions such as posttraumatic stress disorder (PTSD), from individuals whose disabilities limit physical activity. In these data, 39 percent of those eligible for the tax credit expansion reported cognitive impairment. The estimates in Table 5 suggest that tax credits have a beneficial employment effect for individuals with both types of disabilities.

Although working-age adults typically do not receive Social Security benefits, disabled workers can receive benefits through the Social Security Disability Insurance (SSDI) program. Indeed, Table 1 indicates that over 40 percent of those targeted by the tax credit expansion reported Social Security income, a significant fraction of whom likely received SSDI.¹⁷ Because earning more than minimal amounts of wage income disqualifies a person from receiving SSDI benefits, we might expect those receiving SSDI to be less likely to take advantage of the tax credits than those not receiving disability payments. The final rows of Table 5 provide suggestive evidence in support of this hypothesis, demonstrating that all of the employment impacts of the tax credits accrued to individuals who were not receiving Social Security payments.¹⁸ Overall, Table 5 indicates that the tax credit program had somewhat heterogeneous impacts, with larger impacts among older veterans, the non-disadvantaged, and those not receiving Social Security disability payments.

The impact estimates in Tables 2–5 clearly demonstrate that tax credit eligibility is associated with higher probability of employment. To examine whether the tax credits affected related labor market outcomes, Table 6 presents estimates of impacts on hours worked, wage earnings, and type of employment. The DDD approach indicates that eligibility for the tax credits increased average hours worked per week by 1.1, while the DDDD estimates are a

¹⁷ Because the sample population is potentially eligible for other types of Social Security benefits, such as survivor benefits, and ACS respondents only report aggregate Social Security payments, the survey does not allow us to identify SSDI recipients with certainty.

¹⁸ This analysis is not fully conclusive, because Social Security payments are potentially endogenous; if SSDI beneficiaries are induced by the tax credits to enter the labor force and forgo receiving benefits, we might also observe this pattern in the data.

more modest 0.58, and in both cases the impacts are statistically significant. Although an increase of 0.58 hours per person may appear small, among the target population of disabled veterans, average weekly hours worked are only 2.9, mainly because a large majority of this population is not working. Thus, this impact actually represents a fairly large increase in labor supply for the target population.

If we assume that hours worked did not change for those who were already working, so that the expansion in hours was concentrated among new hires, than the DDDD estimates imply that the average new hire worked for 33 hours per week (0.577/.0177). Given that the tax credit is graduated and thereby incentivizes employers to ensure that new hires achieve at least 400 hours during the first tax year in which they are employed, the fact that new hires appear to have worked substantial numbers of hours per week is perhaps unsurprising. Further evidence that the tax credit primarily increased employment in jobs with higher hours is given in the next rows of Table 6, which directly considers full-versus part-time employment as the outcome variable. Although the DDDD estimates for full time employment are only marginally significant ($p = .052$), the relative magnitude of the point estimates suggests that new employment was concentrated among full-rather than part-time hires.

The final row of Table 6 considers impacts on wage income.¹⁹ The impacts of tax credit eligibility on wage income were substantial, with my preferred DDDD estimates suggesting that wage income among eligible groups increased by 40 percent following the implementation of the new credit. If wage income can be considered a proxy for labor market productivity, the fact that the credits appear to have substantially increased wages suggests the tax credits may have had important productivity benefits.

Cost Calculations

How large were these estimated employment gains relative to the costs of the tax credits? While it may appear that the cost of the tax credit per job generated should simply be value of the tax credit (in this case, up to \$4,800) plus any administrative costs of the program, actual program costs per job generated

Table 6
Impacts of Tax Credit Eligibility on Other Labor Market Outcomes

Outcome	Estimation Approach	
	DDD	DDDD
Hours per week	1.07** (0.33)	.577* (.267)
Part-time employment	-.001 (.001)	.005* (.002)
Full-time employment	.024** (.007)	.013 (.006)
% change in wage income	35.7** (12.2)	39.9** (6.8)

NOTES: This table reports DDD and DDDD regressions analogous to those in Table 2, where the outcomes are as listed in the table. See notes for Table 2.

may be higher or lower than this amount. Because the tax credit is available to both employers who were induced to hire disabled veterans as a result of the credit and those who would have been hired even had no credit existed, it is possible that there are multiple credits paid per new job created. When this occurs, the program cost per job generated might be substantially above the \$4,800 credit cap per worker. For example, Bartik (2001) argues that for the TJTC, the “windfall wastage” rate—or fraction of tax credits spent to subsidize hires that would have occurred even in the absence of the hiring incentive—was around 70 percent, which if applied to the WOTC would imply a cost per hire of up to \$16,000. Alternatively, if the availability of the credits induces greater job search effort among covered individuals, it is possible that the credits may lead to hires in industries, such as the federal government, that are not eligible for the credits; moreover, it may be the case that some employers make hires intending to take advantage of the tax credits but never do so. In these situations, the cost per new hire might fall below the actual value of the tax credit, because the government does not pay credits for every employee who was hired as a result of the existence of the credits.

Unfortunately, precise accounting data on the cost of the tax credit expansion to disabled veterans are elusive; in particular, to my knowledge there is no data source that tracks the amounts of tax credits received for specific categories of workers covered under the WOTC. One of the few sources of data on the budgetary cost of the WOTC is the annual Statistics of Income (SOI) series released by the Internal Revenue Service (IRS). SOI tabulations report that, based on a sample of corporate and individual tax returns, in tax year 2007 there was an estimated

The impacts of tax credit eligibility on wage income were substantial, with estimates suggesting that wage income among eligible groups increased by 40 percent.

¹⁹ Estimating wage impacts here is complicated by the fact that the wage distribution is multimodal and includes both a large number of zeros and a thick right tail, meaning that OLS specifications in levels or logs and Poisson regression are all potentially problematic. To estimate the impacts, I used an inverse hyperbolic sine transformation (Burbridge et al., 1988; Pence, 2006) for the dependent variable (wage earnings) and calculated percentage changes from the resultant coefficient estimates using the delta method. Estimation using $\log(\text{wage earnings} + 1)$ as the dependent variables generates very similar results.

This paper provides some of the first quantitative evidence demonstrating that employer tax credits can be successful at improving employment rates among disabled veterans.

\$562 million in WOTC tax credits received by conventional corporations and \$224 million received by S corporations (IRS, 2007; Bryan, 2009).²⁰ Budget data for the Department of Labor (2011) suggest that the budgetary cost of administering the WOTC program in 2007 was about \$18 million, placing the total federal cost of the program in that year at \$804 million.

SOI data indicate that, between the pre-expansion years of 2005–2006 and the post-expansion years of 2007–2008, total WOTC tax credits received by conventional corporations rose by 44 percent. Assuming a similar rate of increase for S corporations,²¹ I estimate that the tax credit expansion cost a total of \$610 million over 2007 and 2008. If we conservatively attribute this entire increase to hiring of disabled veterans, the cost per job-year comes to approximately \$10,000.²²

To provide some context for that cost number, Bartik (2001) estimates that the TJTC cost about \$7,900 per job generated in 2007 dollars, a magnitude roughly on par with my estimates for the WOTC. Data in Eissa and Liebman (1996) and Hotz and Scholz (2003) suggest that an expansion of the Earned Income Tax Credit (EITC) in 1987 increased employment among low-income women with children at a cost of approximately \$6,100 per job generated. The Council of Economic Advisors (2011) estimates a cost per job-year of around \$150,000 for the ARRA, while Wilson (forthcoming) estimates a \$125,000-per-job cost for the stimulus. In an experimental evaluation of the Job Corps program—a program designed to provide employment training for disadvantaged youth—Schochet et al. (2008) present impact estimates suggesting a program cost per job generated of approximately \$290,000. Although one must be cautious in comparing the cost per job of the WOTC to initiatives such as the ARRA or EITC that have other goals beyond simply expanding employment, the comparatively low cost of the WOTC expansion relative to some other initiatives that also seek to create jobs suggests tax credits may be an important channel for reducing veteran unemployment.

²⁰ An S corporation is a corporate organizational form commonly used by corporations with partnership structures. Income and tax credits of S corporations are passed through to shareholders annually, who report these on their individual tax returns.

²¹ Unfortunately, data on WOTC credits received by S corporations were not available in all years.

²² This is likely to be an overstatement of the true cost, since some of the other WOTC target groups, such as high-risk youth, were expanded at the same time that disabled veterans became eligible, so only a fraction of the new expenditures likely funded hiring of veterans. It is also possible that expenditures for other groups changed between 2005–2006 and 2007–2008.

The costs of the tax credits can also be assessed relative to their wage impacts, which may provide a better indication of the productivity and welfare effects of the credits. The DDDD estimates presented in Table 5 indicate that eligibility increased annual wage income of the target group by 40 percent, which equates to roughly \$1,000 per eligible individual. Over 2007 and 2008, this translates to \$3.2 billion in additional income for the target group of veterans, an amount substantially above the upper bound estimate of \$610 million in costs. Even if we assume that the marginal product of newly hired workers was below the wage increase due to the fact that wages for the target population were subsidized, the credits appear to have generated several billion dollars' worth of additional economic output.

Conclusions

Among the myriad federal programs available to assist unemployed veterans, few have been subjected to the rigorous empirical evaluation necessary to establish whether they are effective at actually getting veterans hired. This paper provides some of the first quantitative evidence demonstrating that employer tax credits, which have become an increasingly popular tool in the federal effort to assist unemployed veterans, can be successful at improving employment rates among disabled veterans. In particular, my analysis demonstrates that a new tax credit introduced in 2007 that provided subsidies of up to \$4,800 to employers who hired certain classes of disabled veterans increased employment among the target population by about 32,000 jobs per year at a cost of roughly \$10,000 or less per job-year.

Since 2008, there have been additional expansions of the WOTC that provided larger dollar incentives for hiring and broadened coverage to a wider set of veterans. Although a definitive evaluation of these more recent expansions awaits further study, the present analysis suggests that those investments may provide a valuable source of labor market support for returning and injured veterans during a period of continued labor market weakness. At the same time, given that this analysis suggests that the benefits of the tax credits may have accrued primarily to certain segments of the disabled veteran population, such as older veterans, it will be important going forward to consider how hiring incentives, such as those in the WOTC, can be designed to benefit the widest possible set of veterans. More generally, this analysis indicates that employer tax credits can be an effective means of enhancing employment even among groups, such as the disabled, who have traditionally experienced low rates of labor force participation. ■

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